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## Introduction

Dietary Supplement (DS) use among persons in the U.S. increased significantly over the last 35 years, and the latest nationally representative data demonstrated that DS use is widespread.<sup>1,2</sup> In the 1970s, prevalence of DS use grew from 23% to 34.9% (National Health and Nutrition Examination Surveys: NHANES I and II).<sup>3-5</sup> By 1994, DS use increased to 40%; and based on the 2000-2001 NHANES, 52% of adults reported taking one or more DS in the month prior to the survey.<sup>1,3-6</sup> DS use varied with socio-economic groups.<sup>7</sup> And, the most recent NHANES reported an association of DS use with both moderate and vigorous leisure time physical activity.<sup>7</sup> Given that nutritional deficiencies in the United States are uncommon, other reasons for this high rate of use must be considered. Martinez et al. suggests that consumption of some of these supplements is “fueled in part by the belief that nutritional supplements can ward off chronic disease, including cancer...”<sup>8</sup>

More military (>74%) use DS regularly than civilians (≈52%) in the U.S.<sup>7</sup> However, “nationally representative” surveys that describe DS use in the U.S., NHANES and National Health Interview Surveys (NHIS) do not include the over 1.3 million U.S. active duty military personnel.<sup>1,6,10</sup> And, the value and safety of these DS are unknown within military populations. Among military users, the most common DS were multi-vitamins or multi-minerals (37.5%), protein and amino acids (18.7%), individual vitamins and minerals (17.9%), combination products (9.1%), and herbal supplements (8.3%).<sup>7</sup> Reasons for DS use among military members were to improve health (64%), provide more energy (31%), increase muscle strength (25%), and enhance performance (17%).<sup>7</sup> Military personnel work and live in highly diverse environments, and face demanding physical and cognitive challenges that may lead to their increased reliance on DS to enhance performance or reduce symptoms.<sup>11,12</sup> Examining the military prevalence of DS use and identifying the types of DS used; and evaluating safety, and exploring other mechanisms for achieving optimal nutrient content in the military member diet vice nutrient supplements are all important issues of U.S military mission readiness and success.

The United States has been at war for over ten years. A whole systems approach to optimal human performance is now more important to military leaders as they prepare for and ensure mission readiness and success. This enduring period of war also brings significant attention on the consequences of war on brain function. The incidence of traumatic brain injury (TBI) [DoD website reports total incidence of approximately 30,000 cases]<sup>13</sup> and psychological trauma [2010 data from MHAT-7 indicates 15.1% for acute stress disorder; 5.3% depression; and 5.6% anxiety]<sup>14</sup> fuels the demand for a systematic, comprehensive exploration of all approaches that can protect the warfighter from brain injury. Research has been reported on DS and nutritional factors that have heart-protective<sup>15</sup>, and diabetes prevention benefits.<sup>16</sup> A preliminary query of PubMed yields over 100 peer-reviewed and indexed publications on the potential benefits of DS use and cognitive performance, psychological wellness and resilience.

Samueli Institute has been conducting a scientific exploration of nutrition, diet, and health for several years. These efforts began under its grant entitled: “Program for Research on Dietary Supplements in Military Operations and Healthcare, The Metabolic Defense (MET DEF) Program.” To date, the MET-DEF program identified the diversity of DS use by warfighters, examined the safety of these products, obtained recommendations through the Institute of Medicine for medical management of DS, held a

workshop that specifically focused on fatty acids and warfighter performance, and modeled an innovative clinical study to demonstrate improved performance by supplementing animal feeding practices to improve the fatty acid profile of eggs and meat which would then be used to improve these ingredients in standard warfighter garrison menus items. The focus over the past year has been on publishing manuscripts based on the “Nutritional Armor for the Warfighter: Can Omega-3 Fatty Acids Enhance Stress, Resilience, Wellness, and Military Performance?” conference first held in 2009. The results of this report and clinical trial will provide an overview of the state of the science and explore the concept of turning that science into action by dietary requirements and food sources of omega-3 fatty acids in the context of military feeding policy. The Optimized Omega-3 (OO3), human feeding study is a proof-of-concept study that enhances chicken feed with omega-3, and substitutes the resulting eggs and meat into an 8 day menu plan and switching menu ingredients from low omega-3 high omega-6 fat source to the reverse to optimize the omega-3 to omega-6 ratios in the blood of consumers looking for changes in their blood and on standard cognitive tests and in tolerance to strenuous fatiguing physical exercise.

## Body

**The Program for Research on Dietary Supplements in Military Operations and Healthcare: The Metabolically Optimized Brain (MOB) Study** targets a more specific aspect of dietary nutrition, feeding policy and guidelines, and human performance with a focus on optimal cognitive wellness and performance. The purpose of the study is to identify the “state of the science” by rigorously exploring the evidence in scientific literature for a “metabolically optimized brain: 1) nutritional and metabolic elements for enhancing cognitive performance (efficacy, effectiveness, and safety of dietary and supplemental enhancement of brain function); and 2) nutrient and dietary possibilities to mitigate cognitive and psychological consequences of brain injury during combat and operational exposures. Then, turning science into action (policy then practice), facilitate knowledge translation through policy recommendations for the U.S. military services (dining facility policy, menu, and practice recommendations) to promote optimal mission-ready brain function and performance; and mitigate cognitive and psychological consequences of brain injury from high intensity training, and combat operations exposures.

### **The MOB Study has 3 specific aims:**

- 1.** Convene a MOB Steering Committee (SC) whose duties will be to:
  - a.** Review the progress and analyze data and preliminary results of the Optimized Omega 3 (OO3) farmer to menu feeding study.
  - b.** Select and support participants for Subject Matter Expert and Clinical Appropriateness panels (SME and AP).
  - c.** Guide the selection of topics to be analyzed by SME and AP panels using Samueli Institute processes of “Systematic Reviews (SR) / Rapid Evidence Assessment of the Literature (REAL©).”
  - d.** Provide high level scientific overview and direction to the panels to assure appropriate program deliverables.

2. Build on the model of the OO3 feeding study to make recommendations for implementing positive results, and next steps in clinical research.
3. Explore and assess the evidence in the literature for a “Metabolically Optimized Brain.”
  - a. Host workshops for the SC, SME panel and AP members to educate them in the methodology for SR/REAL process so that they can engage in the research as subject matter experts.
  - b. Convene a SME Panel to conduct 4 Systematic Reviews/REALS© to identify, collate, and rigorously assess the scientific evidence for dietary and DS enhancement of brain function for warfighters.
  - c. Convene an AP to review the analysis and recommendations of the SME panel, and the evidence produced from the SR/REALS©, so as to develop recommendations that will inform next steps for clinical research and senior military policy implementation to promote a “Metabolically Optimized Brain” for the warfighter.

## Key Research Accomplishments

### MOB Steering Committee (SC)

- The MOB SC met monthly from May through December 2013 to set program milestones, tasks, deliverables, budget allocations, and provide high level scientific oversight and guidance to assure appropriate program deliverables.
- The MOB SC members include:
  - Wayne B Jonas, MD; CEO and President, Samueli Institute
  - Joan A. G. Walter, JD, PA; COO, Samueli Institute
  - David M Eisenberg, MD; Executive Vice President, Health, Research and Education, Samueli Institute
  - Kevin G Berry, MD; Vice President, Military Medical Research Programs, Samueli Institute
  - Alberto Ascherio, MD, Dr. P. H.; Professor of Epidemiology and Nutrition, Department of Epidemiology, Harvard School of Public Health
  - Scott J. Montain, Ph.D.; Chief, Military Nutrition Division, United States Army Research Institute of Environmental Medicine (USARIEM)
  - Amber Shryer, PhD(c), M.S.; Grants Officer Representative, TATRC
  - Rachael Yehuda, PhD, Professor of Psychiatry and Neuroscience; Director of the Traumatic Stress Studies Division at the Mount Sinai School of Medicine; PTSD clinical research program and the Neurochemistry and Neuroendocrinology laboratory at the James J. Peters Veterans Affairs Medical Center.
  - Heechin Chae, MD; Psychiatrist and Acupuncturist; Chief of the Traumatic Brain Injury Department at Fort Belvoir Community Hospital
- The SC members received a background and progress summary of the OO3 Diet Study.
- SC discussions established an appropriate focus for literature research topics that will be considered and finalized by a SME Panel to identify the state of the science in the literature for diet and nutrition elements that promote a “metabolically optimized brain.”

- With SC guidance, the Samueli Institute Systematic Review and Support Team conducted a comprehensive review of the scope of the appropriate research related to a MOB to enable the SC to develop the necessary guidance about relevant topics that will be explored in subsequent systematic reviews.
- Upon review of the information from this initial screening of the literature, the SC established their guidance for the SR/REAL© processes that would be refined, initiated, and analyzed by the SME Panel; the parameters of the broach research question included:
  - The primary question: “What is the state of the science and evidence for the effectiveness of various ingested nutrients in the optimization, maintenance, prevention and recovery from disruption of cognitive brain function?”
  - The included population: all human populations will be considered (will also flag military and consider animal studies after initial look at human literature).
  - The outcome: “cognitive brain function”
  - The SC finalized the specific literature search elements of the intervention (“various ingested nutrients”) and a more refined definition for “cognitive brain function.”
- The SC selected the following SME panel members:
  - Patricia A. Deuster, Ph.D., MPH; Professor at the Uniformed Services University of the Health Sciences School of Medicine in the Department of Military and Emergency Medicine, Maryland
  - Angela Drake, PhD; Clinical Professor, Department of Community Health, School of Health and Human Services, National University, La Jolla, CA
  - Michael Irwin, MD; Professor, Department of Psychiatry and Bio-behavioral Sciences, at the David Geffen School of Medicine, UCLA; Director, Cousins Center for Psychoneuroimmunology, UCLA Neuropsychiatric Institute, CA
  - Danny Jaghab, COL, USA; MS, RD; MEDDAC Commander, Kimbrough Ambulatory Care Center and Andrews Institute for Orthopaedics & Sports Medicine, Fort Meade, Maryland
  - Lynn Lafferty, PharmD; Professor, Integrative & Complementary Medicine; College of Osteopathic Medicine, Nova Southeastern University, Ft. Lauderdale, Florida
  - James Snow, M.A., RH(AHG); Academic Director, Integrative Health Science, Maryland University of Integrative Health; Acting Director of the Integrative Health Sciences Department at Tai Sophia Institute, Maryland
- The SME panel members received a background and progress summary of the OO3 Diet Study
- The SC and SME panel members received training on the methodology and their roles and responsibilities for the SR/REALs processes (**through a series of video-teleconferences**) that included:
  - **“PICOS”**: Surveying the available literature on the specific **“population, intervention, comparison, and outcome, and study design”** parameters relevant to dietary and DS enhancement of brain function.
  - The process of assessing the literature for quantity, quality, safety, and effectiveness using appropriate assessment tools.

- The process of summarizing and synthesizing the results; identifying gaps, limitations, and strengths of the research, and developing overall recommendations for moving forward in the field for research.

### Subject Matter Expert (SME) Panel

- SME panel members met regularly from December 2013 through March 2014.
- SME panel members agreed with the SC pre-definitions and guidance, and developed the following:
  - Primary Research Question: ***“What is the state of the science and evidence on the effects of various dietary substances and dietary supplements on cognitive functioning of the brain?”***
    - The broad research question will assess the state of the science of dietary substances and supplements to optimize and maintain optimal cognitive function, and prevent and facilitate recovery from disruption by determining:
      - Beneficial foods for particular military settings.
      - Appropriate dosing and delivery methods.
      - Research gaps in the literature.
      - Next steps recommended for research in the field.
      - Anticipated clinical implications that will inform menu recommendations about food components and improved feeding policies for military service members.
  - The PICO parameters (criteria) that guided study selection included the following:
    - **Population:** “adult human populations” (aged 17 or greater); animal studies would also be considered at the initial screen to assess their numbers and relevance.
    - **Intervention:** “a dietary substance or supplement.”
    - **Outcome:** related to “cognitive brain function.”
    - **Study design:** “peer-reviewed, randomized control trial studies presented in the English language.”
- With final approval from the SC and SMEs, The Samueli Institute Systematic Review and Support Team began the “screening phase of the systematic review of the primary research question” in mid-Jan 2014.
- A MOB systematic review “screening rule book,” established as a result of the PICO parameters, guided the Samueli Institute Systematic Review and Support Team during the data extraction process.
- The SC and SME panel members received a summary of the screening results and theming categories in early March for preliminary review, feedback and questions.

### Summation and Review Conference, held on March 26, 2014 for SC and SME Panel Members

- The SC and SME Panel members met in an all-day, face-to-face conference at Samueli Institute on March 26, 2014:
  - To review the results of the initial broad question screening.



- To choose four specific and related research questions for maximum impact on MOB for the military that emerged from the themes identified in the screening phase of the systematic review of the primary research question.
- After reviewing the materials, the SC, SME panel, and Samueli Institute Systematic Review and Support Team agreed to four themes from which to develop four research questions that would then undergo a more in-depth systematic literature review related to the primary research question.
  - The four themes included: **1) whole food diets; 2) non-alcoholic and non-caffeinated beverages; 3) fatty acids; and 4) phytochemical-rich foods and extracts.**
  - Completion of these reviews will lead to recommendations for military menus regarding macronutrient ratios, manipulation of dietary fats, and consumption of phytochemical-rich foods.
  - Although **“caffeine”** was also ranked toward the top, there may already be ample literature and adequate summaries through military and IOM reviews on the evidence and recommendations for caffeine inclusion in dietary guidance (these reports would be added to the SME panel process for additional consideration beyond the four themes chosen above).
  - There was also a consensus regarding:
    - The importance of **“Farm to Function”** with the expectation that the items studied could easily be incorporated into military dining facility menus.
    - An emphasis on exploring the **impact of “whole dietary patterns” with the focus on “food” rather than “dietary supplements.”**
  - The Samueli Institute Systematic Review and Support Team is currently conducting further research to evaluate the available literature reviews on “caffeine.”

#### Future Plans:

- Finalize the research questions involving the four approved themes from the initial broad research question.
- Complete the four systematic reviews on the approved research questions for analysis by the SME Panel.
- Convene a roundtable with SC and SMEs to discuss results and recommendations for an AP.
- Recruit and convene an AP to develop future research recommendations, clinical implications, and military menu and feeding policy recommendations based on the SME Panel assessments and recommendations.
- Continue dialogue on the progress of MOB with the SC and expert panel members involved.

### Reportable Outcomes

1. The **primary broad research question and its parameters** were finalized by the SMEs and approved by the SC in Jan 2014:

- a. ***“What is the state of the science and evidence on the effects of various dietary substances and dietary supplements on cognitive functioning of the brain?”***
    - b. The Samueli Institute Systematic Review and Support Team conducted a comprehensive initial screening of the literature within the PubMed / Medline, Cochrane, Embase, Cinahl and PsycInfo databases.
    - c. Of the 7045 abstracts that met the “PICO” parameters during the search, 954 (13.4%) abstracts were identified for summation and categorization related to the primary broad research question.
  2. A summary of the **“PICO” parameters** results included:
    - a. **Population** (adults, 17 years old or greater)
      - i. Most studies included healthy adults.
      - ii. Of the studies involving an associated condition, many involved populations with some form of cognitive impairment (e.g., Alzheimer’s disease, mild cognitive impairment or dementia.).
    - b. **Intervention** (dietary substances or dietary supplements)
      - i. Fourteen major groups emerged according to intervention from the screening process: Caffeine / Energy; Alcohol; Vitamins / Minerals / Antioxidants / Dietary supplements (not specified); Herbal Medicine (Subsets: Ginseng and Ginkgo Biloba); Diet / Whole Food / Macronutrients / Beverages (Subsets: Fatty Acids; Amino Acids; Glucose); Isolated Plant Compounds; Hormones; Probiotics; Animals studies (which were bucketed independent of the other categories); and Other.
    - c. **Outcome** (cognitive brain function)
      - i. Cognitive function outcomes included: memory, verbal fluency, attention and vigilance, reaction time, psychomotor performance and / or problem solving and reasoning.
      - ii. Secondary outcomes were also extracted for consideration, and themed so as to group according to the most prevalent: performance/function, energy including sleepiness and fatigue, affect including anxiety, mood and depression, and cardiovascular groups emerged.
3. **March 26, 2014 Initial Screening Summation and Recommendation Conference:** The members of the SC, SME Panel, and Samueli Institute Systematic Review and Support Team reviewed the results of the initial screen, agreed by consensus on the four most important categories for subsequent systematic reviews (SR) related to the primary broad research question. They came to the following conclusions, and agreed to the following next steps:
  - a. **The Four major themes for which research questions would be developed for SR included:**
    - i. **Whole Food Diets** 27 abstracts were identified that involved **diet or manipulation of diet** as an intervention on the healthy adult population. Many of these diets involved the macronutrient balance of carbohydrates, fats and proteins.

- 1) While systematic reviews have already been conducted on macronutrient balance and cognition (Dye 2000 & Hoyland 2008), as well as Mediterranean diet and cognition (Lourida 2013) there has yet to be a review performed across all whole food diets and cognitive function.
  - 2) **A systematic review looking at diets across the various outcomes related to cognitive function in the healthy adult population will be beneficial to the MOB initiative.**
  - 3) Performing this review would provide a baseline upon which further recommendations could be made. Because the studies are quite heterogeneous and we will review only the small number that are RCT study design, there are likely to be many gaps in this analysis. This will be useful for recommending a future research agenda. Also this category is consistent with the focus on “farm to function” for impact.
- ii. **Beverages (non-caffeinated & non-alcoholic):** 13 abstracts were identified that involved non-caffeinated and non-alcoholic beverages as an intervention, including one on hydration, on the healthy adult population.
- 1) A separate review on beverages would help round out an exploration on the state of the evidence of whole food diets on cognitive function.
  - 2) **A systematic review looking at non-caffeinated and non-alcoholic beverages across the various outcomes related to cognitive function in the healthy adult population will be beneficial for the MOB Initiative.**
- iii. **Fatty Acids:** 24 abstracts were identified that involved fatty acids as an intervention on the healthy adult population.
- 1) A systematic review with a narrowly defined PICOS (elderly population both healthy and with memory or cognitive decline) has been conducted (Mazereeuw 2012).
  - 2) **A systematic review looking at fatty acids across the various outcomes related to cognitive function in the healthy adult population will be beneficial for the MOB Initiative.**
  - 3) Fatty acids can more readily be incorporated into dining hall menus compared to other substances that arose.
- iv. **Phytochemical-rich foods and extracts:** 39 abstracts were identified that involved phytochemicals as an intervention on the healthy adult population. These abstracts were pulled from several different intervention categories, including herbs, whole foods and isolated plant compounds.
- 1) With an emphasis on “whole food” rather than “supplements,” phytochemical or phytonutrient-rich foods will be the primary focus including unprocessed or minimally processed plant foods as well as culinary herbs and spices.
  - 2) While a systematic review has already been conducted on phytochemicals and cognitive function (Macready 2010), this review

only included micronutrients and flavonoids in extract form, excluding these nutrients in whole food form (definitions were not clearly detailed in this SR methodology and confusion exists on how the reviewers decided to group these studies for inclusion).

- 3) **A systematic review for the MOB Initiative is considered beneficial looking at phytochemical-rich foods across the various outcomes related to cognitive function in the healthy adult population.** Although the relevant studies are heterogeneous in food preparations, a review of this kind will address potential policies for fruits, vegetables and other minimally processed plant-based foods in the military diet.

b. **Interventions in which One-Page Summaries of Evidence will be provided to the SME**

**Panel:** The MOB study proposed to perform only four systematic reviews. The SC and SME Panel recommended starting with an initial screening of a broad primary research question to assess the scope of existing relevant research. Using this approach, 14 major intervention themes emerged across the literature. Some of these themes have already been reviewed extensively and reported. Therefore, the Samueli Institute Systematic Review and Support Team will provide one-page summaries of the best evidence available for **caffeine, vitamins, herbs (bacopa monniera, ginkgo biloba, and ginseng) and glucose**. Summaries will report methodological issues of the systematic reviews, a summary of the evidence and research gaps. SMEs will have these summaries as well as the final results of the four detailed systematic reviews provided through this study when making final conclusions and recommendations. These additional summary reports quickly and easily identified for a broader range of relevant themes bears out the wisdom of starting with a broad primary research question to discover and include the maximum information available bearing on the MOB study objectives.

- i. **Caffeine:** 169 abstracts identified that involved **caffeine** as an intervention on the healthy adult population. Existing SR focus on a very narrowly defined PICOS<sup>1</sup> in relation to shift workers / jetlag (Cochrane, 2010), athletes and fatigue. The Institute of Medicine (IOM) released the report: “Caffeine for the Sustainment of Mental Task Performance: Formulations for Military Operations,” in 2001<sup>2</sup>. The IOM also released a report addressing caffeine consumption safety issues<sup>3</sup>. Caffeine is of particular interest to the military due to its ubiquitous consumption in the military.
- ii. **Vitamins:** 24 abstracts identified that involved **Vitamin B**; 17 abstracts for **multivitamins**; and 81 abstracts for **single vitamins, minerals, antioxidants, dietary supplements (not specified) or various combinations** as interventions

<sup>1</sup> PICOS = Population, Intervention, Control, Outcome, Study design

<sup>2</sup> Committee on Military Nutrition Research, Food and Nutrition Board. Caffeine for the Sustainment of Mental Task Performance: Formulations for Military Operations. National Academy Press. Washington, DC, 2001. Important to note: much of this summary is taken verbatim from this report.

<sup>3</sup> IOM (Institute of Medicine). 2014. Caffeine in food and dietary supplements: Examining safety: Workshop summary. Washington, DC: The National Academies Press.

on the healthy adult population. Systematic reviews have been conducted on cognitive performance and multivitamins (Grima 2012), Vitamin B and cognitive performance (Balk 2007), single vitamins, minerals and antioxidants.

- iii. **Herbs:** 12 abstracts identified that involved “**bacopa monniera**” and 45 abstracts that involved **gingko biloba**, **ginseng**, or a combination as an intervention on the healthy adult population. A systematic review has been conducted for ginseng and cognition; gingko biloba research has been well reviewed in a recent meta-analysis; and two recent meta-analyses have been conducted on bacopa monniera and cognitive function.
- iv. **Glucose:** 30 abstracts identified that involved **glucose** as an intervention on the healthy adult population. A systematic review has been conducted on macronutrients and cognition, looking specifically at the role of glucose (Hoyland 2008).

c. **Other Intervention Groupings considered:**

- i. **Herbal Medicine:** 58 abstracts identified involved **herbal medicine** (excluding gingko biloba and ginseng) as an intervention on the healthy adult population. 31 separate **herb or herbal preparations** emerged. However, due to the significant heterogeneity in this category, the SC and SMEs agreed performing a review on this topic would not result in the decisive information needed for recommendations. Furthermore, the nature of herbal medicine makes this category less conducive to menu recommendations. Therefore this category was excluded.
- ii. **Amino Acids:** 29 abstracts identified that involved **tryptophan or tryptophan depletion**, and 68 abstracts involved **various amino acids** as an intervention on the healthy adult population. No systematic reviews have been conducted for tryptophan or tryptophan depletion, and none looking across all amino acids on cognitive function. The consensus of the group was to exclude this category in favor of focusing time and resources on the primary four categories identified above.
- iii. **Hormones:** 13 abstracts identified that involved **melatonin** as an intervention on healthy adult populations. The majority of systematic reviews for melatonin focused on its effect on sleep. The complexity of recommending the consumption of hormones prompted the exclusion of this category and specifically melatonin.
- iv. **Alcohol:** 17 abstracts identified that involved **alcohol** as an intervention on the healthy adult population. Although it is recognized that alcohol is widely consumed in military populations and has an effect on cognitive function, the complexity of recommending any alcohol in a regular diet prompted the exclusion of this category also.
- v. **Probiotics:** 2 abstracts identified that involved probiotics in healthy populations (literature on probiotics and cognitive function is rare).

- i. **Animal Studies:** 29 abstracts identified that involved 24 separate interventions in animals.

**d. Cognitive Function Outcome Themes**

- i. **The table below** illustrates the type of cognitive function outcomes studied for each intervention considered for review. Categorization for cognitive function outcomes has not been standardized. For example, some authors categorize a certain task as a measurement for memory while another may categorize the same task as measurement for attention. These outcomes work in tandem with each other. The MOB SC and SME panel members recommended that analysis should consider cognitive function as a global outcome, and further categorization as subgroup analyses. There was debate as to whether any of these subsets were of more relevance to the military than others, in an effort to narrow the research questions. In the end, it was agreed that a global stance encompassing the full spectrum of cognitive outcomes was more appropriate. During the review phase, outcome themes can be extracted, categorized, and considered again.

	Diet	Caffeine	Beverages	Fatty Acids	Phytochemicals	Amino Acids	Isoflavones	Melatonin	Herbs	Tryptophan
# of studies involving HEALTHY subjects	27	169	13	24	28*	61	19	13	58	28
Global / Not Specified	8	19	6	9	15	8	1	2	13	1
Memory	6	52	4	13	15	38	12	2	73	16
Verbal Fluency	1	0	0	2	3	1	6	0	2	0
Attention & Vigilance	7	73	3	9	6	20	3	7	45	11
Reaction Time	5	48	1	7	1	8	0	5	9	1
Psychomotor Performance	1	35	0	1	0	2	0	1	13	1
Problem Solving & Reasoning	2	21	0	5	2	11	7	2	11	5
Uncategorized	6	36	2	8	9	26	8	3	47	11

\* 39 studies involved phytochemicals. Of these, 28 studies involved phytochemicals in the whole-food form and 11 in the extracted or tablet form. Although the whole-food form is the primary focus, evaluations of both will be considered.

## Conclusion

The MOB Study is currently on schedule to complete the aims, tasks, and deliverables approved in the grant award, but under budget at the end of the first year due to timing. The original plan was for the Steering Committee (SC) and Subject Matter Expert (SME) Panel to craft 4 separate and sequential systematic review research questions related to a “metabolically optimized brain.” However, upon several collective discussions, the SC and SME Panel members decided to conduct an initial screen of the literature related to a broad primary research question. Then, using the categorized results and evident themes, prioritize and establish four focused and inter-related systematic reviews, and take advantage of systematic reviews and meta-analyses already available that, in the end, will provide more relevant information that will be used by the Appropriateness Panel members to make the anticipated whole food research and military feeding policy recommendations. The primary broad research question has been decided, the initial screen of the literature completed, and the **first planned face-to-face conference was convened on March 26, 2014** to review the results and make recommendations for the four most relevant systematic reviews which will be conducted simultaneously beginning in June 2014 instead of sequentially as initially envisioned. There will be a heavier pull-down of resources in a shorter period of time during the technical steps of the four systematic reviews in the next few months.

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## Appendices

None